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Flood Monitoring Early Warning System using Internet of Things-based Telegram

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Abstract

Technology can be considered a human invention that is used to facilitate human activities. In the current increase and growth of technology, there are many technologies that have been created from time to time. Flooding is a natural disaster that can be caused by human behavior itself. Many floods occur due to blockage of water flow in gutters or drainage systems. The impact of a flood disaster are many things that harm us, if a flood occurs, it doesn't just result in material loss, it can even cause loss of life. Therefore, this research aims to create an Early Warning System for handling flood disasters based on the Internet of Things (IOT) using telegram as a monitoring control. According to the rule, if the water level distance is less than 10 cm, then the water level will be declared safe from flooding. Then, if it is greater than 10 cm and less than 15 cm, a flood warning will be issued, and if the water level is more than 15 cm, there will be a danger of flooding. The results of this research will show that this tool can detect water levels and send a warning/notification from the Telegram application.

I. INTRODUCTION

Technology can be considered a human invention that is used to facilitate human activities. In the current increase and growth of technology, there are many technologies that have been created from time to time. Based on data from the website (sasanadigital.com), starting from Technology or Era 1.0 (1760 – 1840) where James Watt created technology based on steam power, then Technology or Era 2.0 (1870s) in this era electricity was discovered, where this technology will focus on machine efficiency in each line (Assembly Line) in the production process.

Furthermore, technology or Era 3.0 (1970s) was characterized by sophisticated hardware and software which would eventually cause field work to be replaced by machines. In this era, the role of digitalization emerged, especially in the industrial world. And then Technology or Era 4.0 (Now), in this era, many technologies have developed, starting with technology that can be controlled remotely and can be connected to the internet. such as Go-jek or Grab, BCA Mobile or M-Banking to Online Stores (Tokopedia). However, now there are technological developments or Era 5.0 that are being built. An example of a country that has implemented this era is Japan. The concepts contained in this Technology or Era will center on a combination of deviations between different parties, such as people, facts, and information progress. Even though the technology in this era can be said to be the same as previous technology (technology 4.0), the focus on these two technologies is completely different. The technology that we know today is very influential on human progress, because the role of technology can replace the role of humans in the industrial world, which is why technology can make everyday life more efficient. There are many tools that have been created to help humans. Now a tool that is really needed by electronic devices is to include a device in the form of a sensor which is used as an intermediary to detect events or situations right away. Such as ultrasonic sensors, microphone modules, Fort sensors, DHT11 sensors and LDR sensor modules.

Internet of Things (IOT) is a concept that aims to expand the always-connected internet connectivity network, allowing us to connect machines, equipment and other physical objects with a network of sensors and actuators that are used to collect data and manage their own performance, allowing machines to move independently according to the information or program provided or ordered. In a presentation in 1999, Kevin Ashton first put forward the concept of the Internet of Things (IOT). The Internet of Things is now used by many large businesses, including Microsot, DycodeX, Hara, Qlue, and others, to improve production [1].

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The Waterfall model was the first model used and is commonly used and is commonly used by government projects and large companies. This model also emphasizes the importance of documentation so this model is suitable for projects that emphasize quality [2].

Flooding is a natural disaster that can be caused by human behavior itself. Many floods occur due to blockage of water flow in gutters or drainage systems. The impact of a flood disaster is many things that harm us, if a flood occurs, it doesn't just result in material loss, it can even cause loss of life. To anticipate the occurrence of a flood disaster, we can create a warning if the water level exceeds its natural limit [3]. Based on this problem, the author will try to create an Early Warning System simulation, where this tool is intended to detect the volume of water height if it has exceeded its natural limit automatically and will also automatically activate the water pump to drain the water in the reservoir or dam which is equipped with an electronic sensor and an Adruino Uno microcontroller as the main controller, and will be monitored with a bot from the Telegram application. The tool that will be designed is intended to help the community anticipate if a flood disaster occurs. Where the bot from Telegram is used for monitoring to notify conditions or circumstances that occur on the tool.

II. RELATED WORKS/LITERATURE REVIEW (OPTIONAL)

Floods can actually be said to be a "normal" natural phenomenon because almost all countries have experienced them and even routinely experience them, including Indonesia. One type of flood that regularly occurs is a flood caused by overflowing river water. Floods also commonly occur as a result of heavy rain in upstream areas and resulting in river water overflowing downstream of the river [4].

The early warning system functions as a notification if a natural event occurs, this early warning system will notify about disasters that will occur, such as floods [5]. This is very helpful in dealing with disasters before flooding occurs.

Monitoring will provide information about the status and trends that repeated measurements and evaluations have been completed from time to time. Monitoring activities are more focused on the activities to be implemented [6]. Monitoring is carried out by digging to obtain information on a regular basis based on certain indicators. If monitoring is carried out well, it will be useful in ensuring that the implementation of activities remains on track [6]. In principle, monitoring is carried out while activities are in progress to ensure the suitability of the process and achievements according to plan, whether achieved or not. If irregularities or delays are found, they are immediately corrected so that activities can proceed according to plans and targets [6].

Telegram used to be a post office facility that was used to send written messages over long distances quickly. Telegram was designed to make it easier for users to send text, audio, video, image and sticker messages to each other safely [7].

Telegram also has a very useful feature, namely the Telegram BOT. Users can send messages, commands, and inline requests. We can control the bot using HTTPS to telegram API. Bots can also be used as special tools, for example providing warnings, weather forecasts, translations, formatting, or other services. Telegram bots are currently popular bots used by many people in various agencies to support the activities they carry out [8].

Telegram not only provides features for online chatting but also adds a bot function with certain functions that operate automatically in response to user commands or requests [9]. Chatbot operation on the Telegram application involves the user entering relevant commands, to which the bot provides automatic responses based on an existing database. If the command is not appropriate, the bot will not send any response [10].

Telegram bot is an Application Programming Interface (API), an open-source technology provided by Telegram Messenger LLP to build Telegram bot applications with a Hypertext Transfer Protocol (HTTP) based interface [11].

Telegram bot is an Application Programming Interface (API), an open-source technology provided by Telegram Messenger LLP to build Telegram bot applications with a Hypertext Transfer Protocol (HTTP) based interface microcontroller programming can be done with IDE (Integrated Development Environment) software which is a collection of command sequences to the computer using language that is easy to understand so that the computer can carry out according to the commands. This programming has two IDE software which is often used by programmers, namely code vision AVR and Arduino IDE [12].

Arduino programming uses C language which has been simplified and is very easy to understand. The C language has structures (void setup and void loop), variables, syntax, mathematical operators, comparison operators and operator structures [12].

Although significant success has been achieved in designing early warning system tools and utilization of the Telegram application. However, there is a contradiction regarding monitoring using mobile phones. This study tries to overcome this contradiction by proposing a new system that exploits Telegram's capabilities for real-time monitoring

III. METHODS

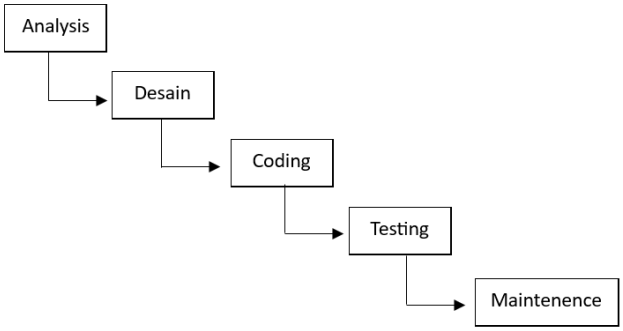

Fig. 1 Waterfall method that will be used

This waterfall model is also known as the traditional model or classic model [13]. The waterfall model uses a systematic and sequential approach. The stages in this model start from the planning stage to the management stage (maintenance) and are carried out in stages [14]. The waterfall model provides a sequential or sequential approach to software life flow starting from analysis, design, coding, testing and support stages [15].

The following is an explanation of the Figure 1 above:
In this research, the first step that will be taken is to analyze the needs for making a flood early warning system tool, analyze the weaknesses and technology that will be used, as well as obstacles or shortcomings in making a flood early warning tool. After carrying out the analysis, the next step is to create a design or design for a flood early warning system tool, system coding, and hardware architecture. In this step, the results of the existing hardware design will be documented and will be implemented in the next stage. After the design stage, coding will then be carried out on the flood early warning system tool which will be created using the Arduino Uno program, where the programming language used is the same as the C++ programming language. After coding the tool that was created, the next step will be to test the tool that was produced. This step is used to find out the shortcomings of the programs and tools created. Such as validating Telegram notifications, whether the notifications received are in accordance with the condition of the equipment. After carrying out the testing step, the next and final step of the waterfall method is maintenance. In this step, maintenance is carried out on the finished tool. This maintenance includes correcting errors that were not found in the previous step.

The Software used for this research includes the components in Table 1.

TABLE 1
THE SOFRWARE THAT IS USE

Software	Tools/Framework
The operating system used to program the tool	Arduino IDE
The operating system used to send notifications	Telegram

The software used only uses Arduino Uno with specifications as described in Table 1
The hardware used for conducting this research can be seen in Table 2.

TABLE 2
HARDWARE SPESIFICATION

Hardware	Spesification
Laptop	Acer Aspire 3 A314-35-C80W, 256 GB SSD, Intel Celeron Processor N5100, 4GB DDR4
Main tools	Wemos D1 R2, Ultrasonic Sensor HC-SR 04 LCD i2c Buzzer LED Lamp Resistor Relay Pompa DC Adaptor 12v 2A

A series of hardware will be designed in one main tool consisting of Wemos D1 R2, HC-SR 04 Ultrasonic Sensor, LCD i2c, Buzzer, LED Light, Resistor, DC Pump, and 12V 2A Adapter and programmed using Arduino IDE. When the ultrasonic sensor reads the water level in the container/reservoir, the data obtained will be processed into Wemos D1 R2, where the Aruino IDE program will carry out commands to the LED lights, buzzer, LCD display and pump according to the programmed conditions.

IV. RESULTS

TABLE 3
RESULTS FROM TESTING THE MAIN TOOL

Conditions	Display on LCD	Hardware Condition (Turning ON "✓" / Turning OFF "×")				
		LED Lights	LCD Display	Buzzer	Ultrasonic Sensor	Water Pump
The device has not been turned on	-	×	×	×	×	×
The device when it is turned on	Monitoring Banjir Oleh Dhika	×	✓	×	×	×
The device when water level is less than 10 cm	Level Air : Aman Pompa Mati	✓	✓	×	✓	×
The device when the water level is more than 10 cm and less than 15 cm	Level Air : Sedang Pompa Mati	✓	✓	✓	✓	×
The device when the water level is more than 15 cm	Level Air : Penuh Pompa Nyala	✓	✓	✓	✓	✓

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Based on Table 3 above, it can be seen that if there is no electric voltage supplying electric current to the main device, then the device cannot be turned on and no data will be displayed on the device. For this purpose, a 12V 2A adapter is used as a connection to the electrical energy source.

Based on table 3 above, it can also be seen that if it is connected to electric current using a 12V 2A adapter, the main device can be turned on. Data that has been programmed from the Arduino IDE can be displayed via the LCD display. The data is divided into 2 sides, the top 1 side displays the words "Flood Monitoring" and the bottom 2 sides display the words "By: Dhika".

Based on table 3 above, it can also be seen that when the water level is less than 10 cm then the data obtained will be processed to Wemos D1 R2 and send the data into information which displayed via the LCD display. This information is divided into 2 sides, the top 1 side displays the information "Water Level: Safe" and the bottom 2 sides display the information "Pump Off".

Based on table 3 above, It can be seen that when the water height exceeds 10 cm and is less than 15 cm, the data generated from the ultrasonic sensor will send information to the Wemos D1 R2 and also send the data into information displayed on the LCD display. This information is divided into 2 sides, the top 1 side displays information "Water Level: Medium" and the bottom 2 sides display information "Pump Off".

Based on table 3 above, it can also be seen that when the water level exceeds 15 cm, the data generated from the ultrasonic sensor will send information to Wemos D1 R2 and also send the data into information displayed on the LCD display.This information is divided into 2 sides, the top 1 side displays information "Water Level: Full" and the bottom 2 sides display information "Pump On".

Fig. 2 Example of a telegram notification

Based on the image Fig. 2, We can see that when the main tool is turned on we can see a notification sent by the telegram bot to our cellphone. This data is data that has been generated from the main device that is connected if we use a personal hotspot that is connected to the main device.

V. DISCUSSION

In this discussion, the research results of the Early Warning System for Flood Monitoring using Telegram based on the Internet of Things will be explained. The following is a brief description of the results of this research:

The main telegram-based tool is able to handle flood problems by providing early warnings. This main tool works well and quickly, including sending telegram notifications to users and also providing quick response, as well as displaying accurate information displayed on the LCD display.In this research, the handling method is integrated by sucking the water discharge in the container/reservoir out through a water pump. The water released will be finished when the water level is less than 10 cm or safe conditions. In this research, there are several limitations that often occur, such as the need for several additional sensors that can enable the main tool to detect floods accurately and precisely, so that error conditions do not occur due to always relying on one sensor. Monitoring must also be expanded by having several other users who can access the information generated on the main tool. This research is only able to carry out monitoring with one user and also only uses one main sensor, namely the ultrasonic sensor.

VI. CONCLUSIONS

A successful design has been developed for an Early Warning System Device connected to an LCD (liquid-crystal display) Display. This design can show the possibility of flooding, the state of the LED (light-emitting diode), the operation of the water pump, and other information. An Early Warning System tool integrated with the Telegram application has been successfully designed. Using Safe, Warning, and Danger categories, this plan can display flood alert notifications. The ultrasonic sensor can determine the height of the air surface, namely 0.11628 s, in less than one second. If the distance is greater than 10 cm, the water level is safe from flooding; if greater than 15 cm, a flood warning will be issued; and if it is less than 15 cm, a flood danger will be declared. To design the main tool, the tool design can use the waterfall method which consists of requirements analysis, tool design, coding, testing and maintenance. Suggestions that can be given in this research, with this research, it is hoped that further research can be developed. starting from adding an additional sensor to regulate air temperature so that it can be used as an additional sensor, then from a monitoring perspective it can be added for the user, and from a handling perspective it can be changed to a better one.

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